



**“Reshaping Portable Power”**

# **10<sup>th</sup> Annual Nanobusiness/ Nanomanufacturing Summit**

September 27, 2011

# Overview of Contour Energy Systems, Inc



## Azusa, California

Headquarters, Corporate R&D and coin-cell manufacturing



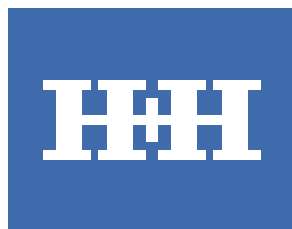
## Yuma, Arizona

Electrode powder manufacturing

- **Spinout from Caltech with focus on Advanced Primary and Rechargeable Batteries**
- **Founded in June, 2007**
- **Two facilities:**
  - Azusa, CA: HQ, cell manufacturing and R&D
  - Yuma, AZ: Electrode manufacturing
- **Raised \$50M (Series A, B and C)**
  - CMEA, USVP, Harris and Harris, Schlumberger, and EDBI
- **Growing rapidly**
  - 42 employees (up from 17 a year ago)
  - Doubled manufacturing and R&D space
- **First Products**
  - Coin cell for 3D glasses
  - Developing World's Longest Lasting D cell and 9 Volt battery



# Blue Chip Technology Partners and Investors



# Contour's World Class Founders and Management

## Founders

### **Dr. Robert Grubbs** **Founder and Director**

- 2005 Nobel Laureate
- Professor of Chem., Caltech
- Founder of several successful high tech companies

### **Dr. Andre Hamwi** **Founder**

- Professor at Univ Blaise-Pascal
- 30+ years electrochemistry experience
- World-renowned expert in fluorine chemistry

## Management

### **T. Joseph Fisher** **CEO**

- 30+ years battery experience
- Extensive domestic and international management experience with Energizer

### **Dr. L.C. Chiu** **COO**

- 25+ years experience in operations and scaling manufacturing
- Former HP executive as well as a successful start up sold to JDS Uniphase

### **Dr. Simon Jones** **VP, Technology**

- 10+ years R&D experience
- 30+ publications in emerging technologies (electrochemistry, electrolytes, nanotechnology)

### **Joe Carcone** **VP, Sales and Marketing**

- 30+ years battery experience
- Proven track record with Sanyo, General Electric and Powergenix

### **Lee Sailor** **VP, Finance**

- 20 years financial + operations experience
- Proven executive with start up and mid size cos.

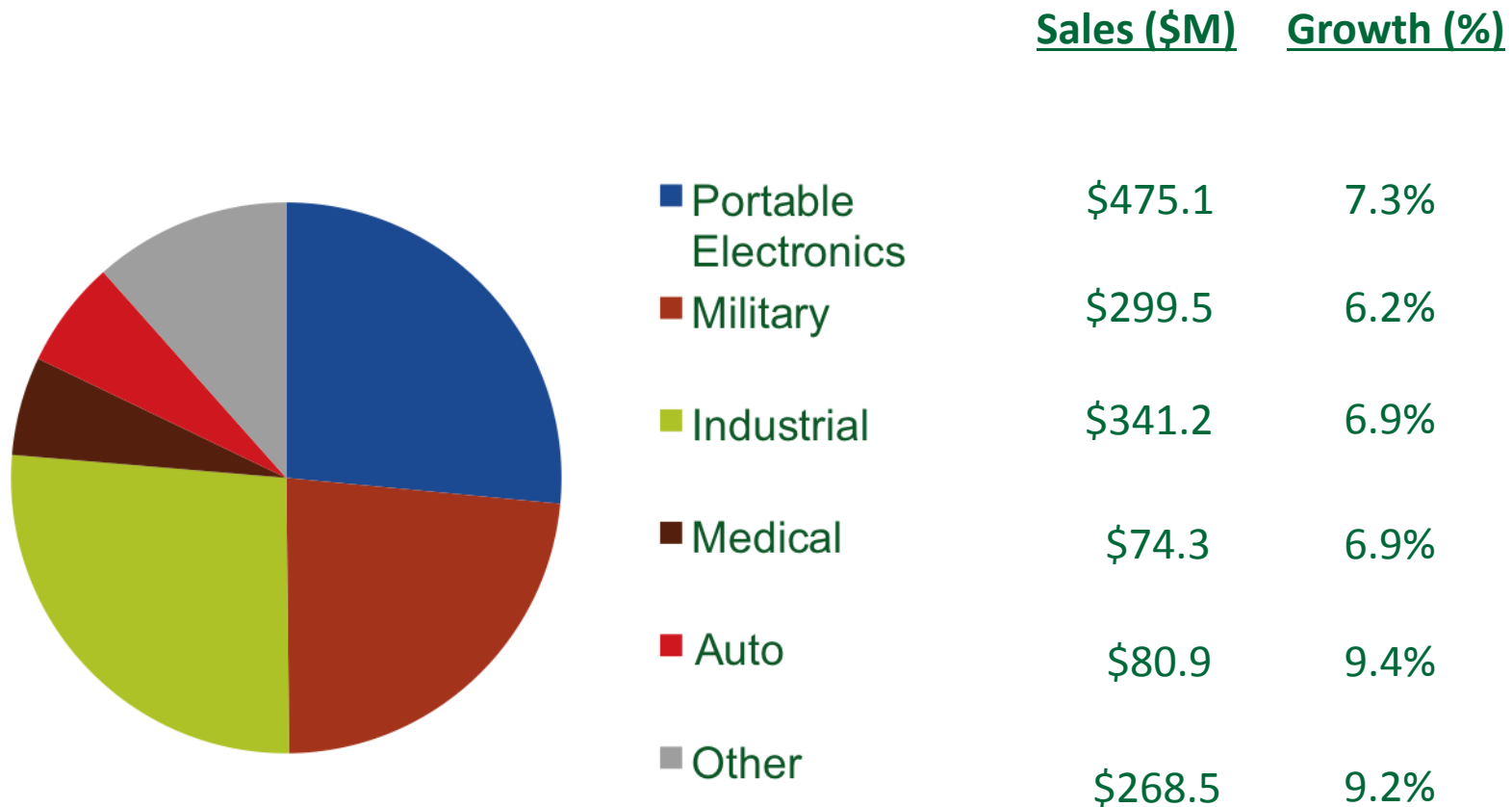
# Key Facts

- **Successfully transitioning from a small start up to a fast moving, results oriented advanced technology and manufacturing company.....**
  - **Currently 42 employees, up from 17 one year ago**
  - **Five (5) Joint Development Agreements with 2 Global Strategics, leading to sales in 2012 and ramping up significantly in 2013**
  - **43 patents and pending patent applications**
  - **Doubled Manufacturing and Lab space in last 6 months.**

# Key Technology Portfolio Strategies

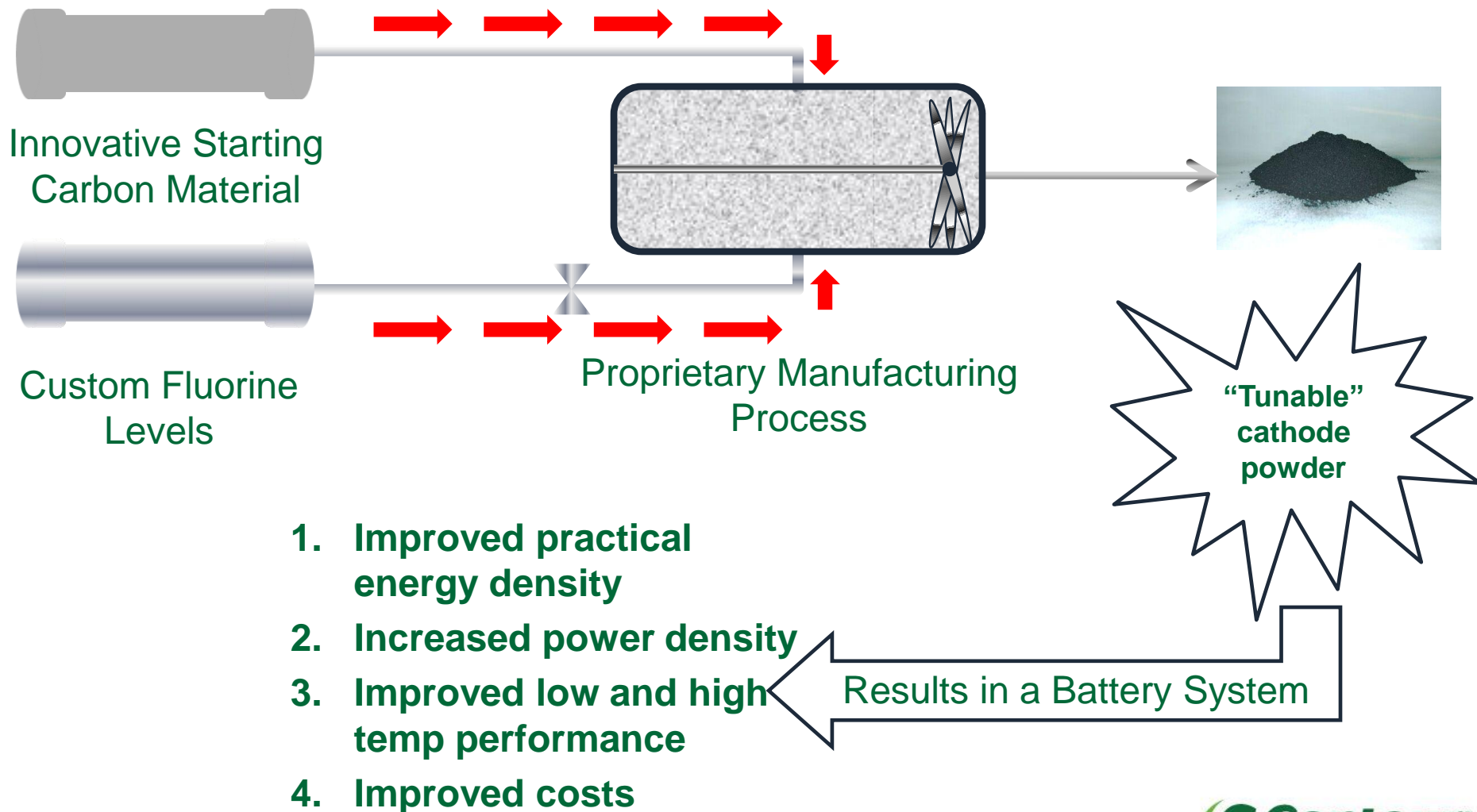
- **Develop and Commercialize our Proprietary Lithium CFX<sub>tm</sub> Primary Batteries**
- **Develop and Commercialize our Next Generation Proprietary Rechargeable Batteries**

# Contour's Primary Products Address a \$1.5B Lithium Primary Market



Source: Frost & Sullivan and CFX Estimates

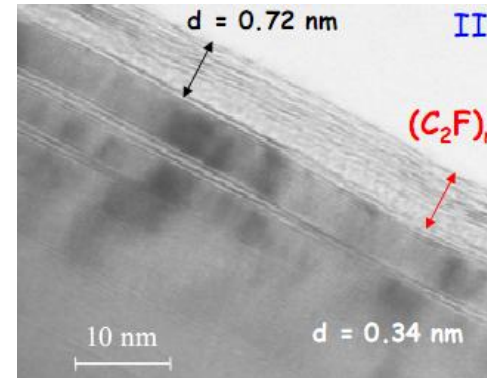
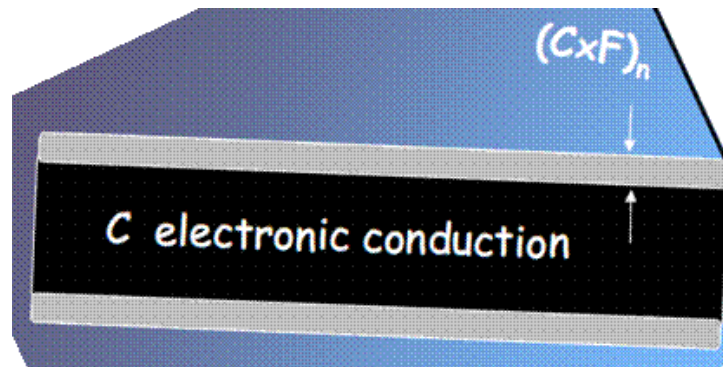
# Contour Energy's Fluorine Based Systems Deliver Superior Results Across the Board



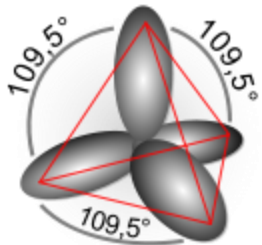


# Contour's Innovations Combine Nanomaterials with Proprietary Fluorination Conditions

- Carbon nanotubes and nanofibers with core-shell structures

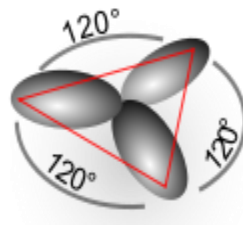


- Graphitic materials with  $sp^2$ -nanodomains



$sp^3$

VS

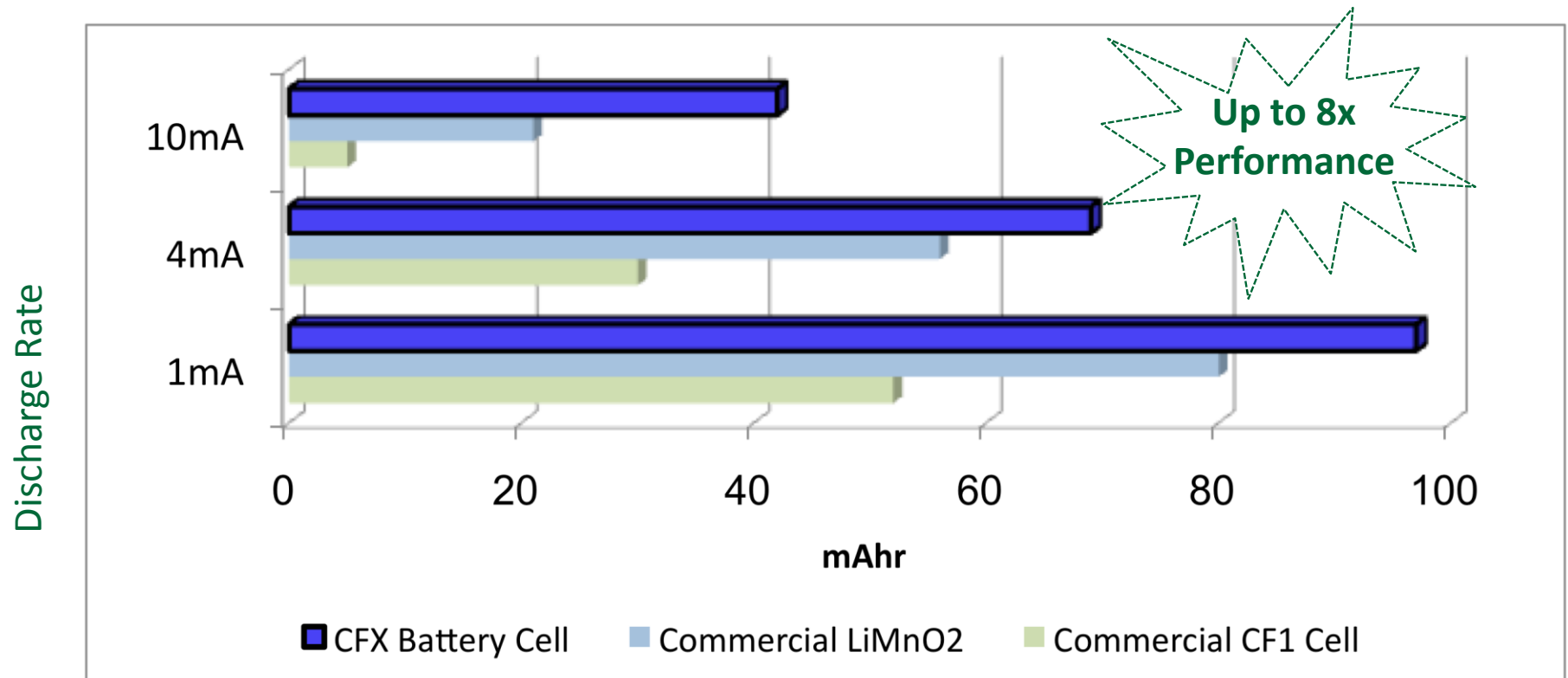


$sp^2$

$sp^2$  = weaker C-F bond, more conductive

Weaker C-F Bond + More Conductive = Higher Power

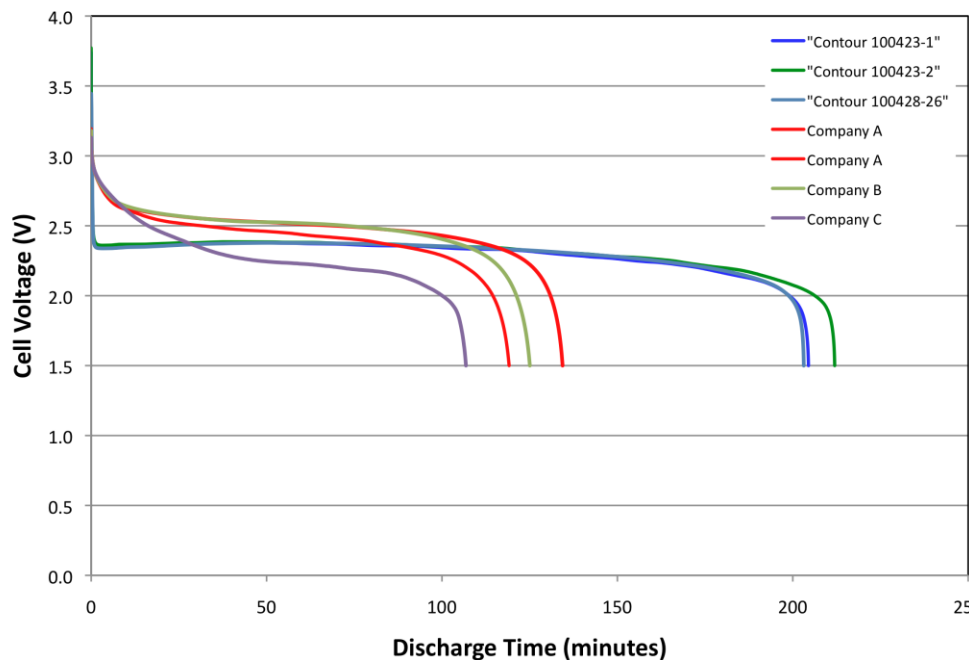
# Contour's Technology Demonstrates Superior Performance Across Various Discharge Rates



Tested on 2016 coin cell to 2V

# Contour Energy's Fluorine Based Systems Deliver Superior Results Across the Board: Power

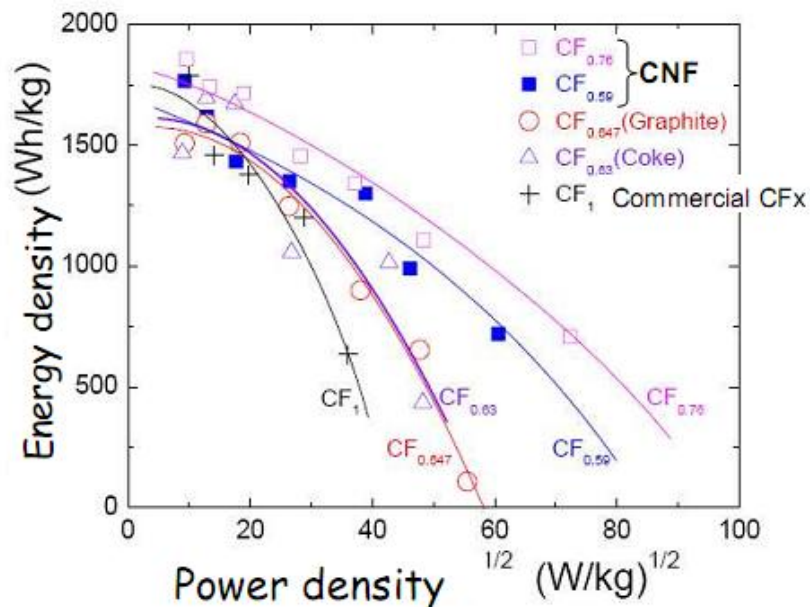
Constant Power 30mW Discharge Curves



Comparison with  
nanofibers



← Powder material  
(independent testing)



# Engaged with multiple OEMs and Organizations



# Why *Contour* Fluorinetic™ Primaries ???

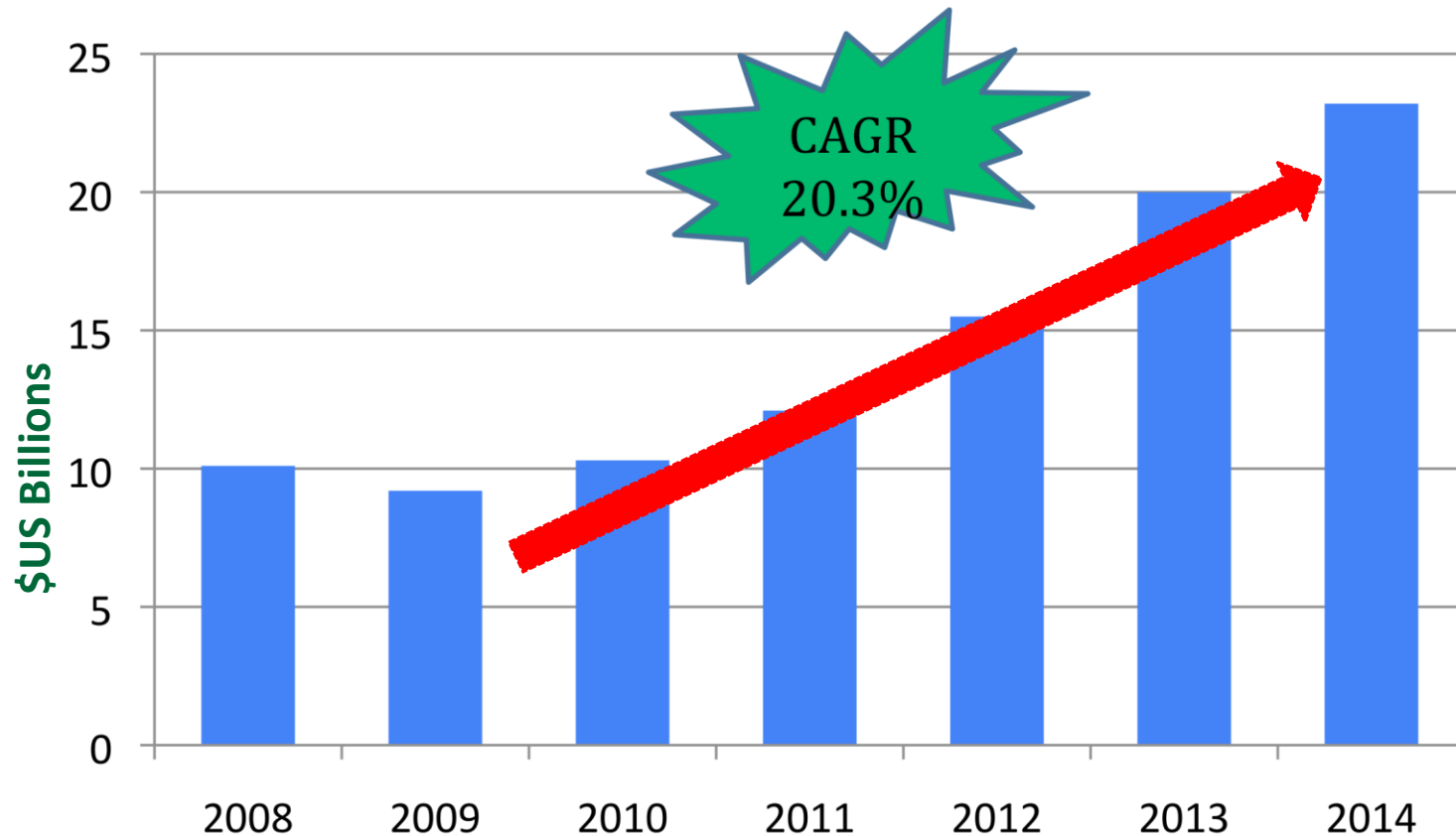
- Superior Runtime - Up to 8X Longer vs. existing products
- Superior Rate Capability – Due to Proprietary Cathode
- Superior Temperature Performance - -60C to 220C
- Superior Shelf Life – Up to 15 Years
- Environmentally Friendly - No heavy metals or toxic elements

**Sales Ramp to \$35mm by end of 2013 growing to over \$100mm by 2015.**

# Key Technology Portfolio Strategies

- Develop and Commercialize Lithium CFx Primary Batteries
- **Develop and Commercialize Next Generation Rechargeable Batteries**

# The Rechargeable Lithium market is large, with upside of the auto & smart grid



Source: ITT, March 2010

# Our Next Generation Rechargeable Batteries

**Contour is working on all the key battery components**

- **Advanced Lithium Ion Batteries**
  - Novel Anodes – Carbon Fiber Composites, Silicon
  - Novel Cathodes – Both Energy and Power
  - Novel Electrolytes – Liquid, Solid State and Ionic
  - Novel Separators – Improved safety, performance and lower cost



# Our Next Generation Rechargeable Batteries

Contour is working on all the key battery components

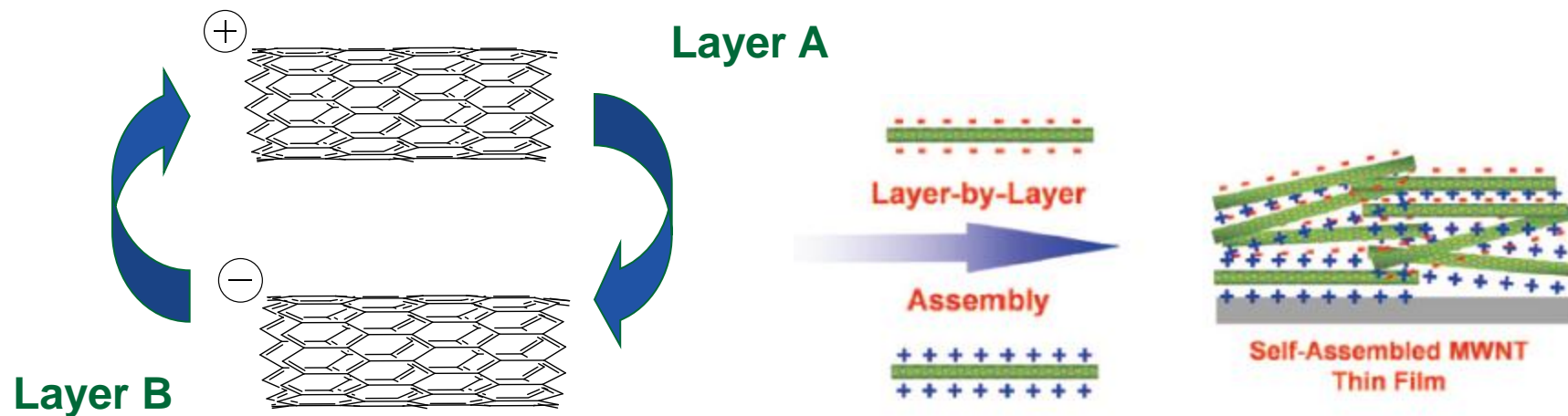
- **Advanced Lithium Ion Batteries**

- Novel Anodes – Carbon Fiber Composites, Silicon
- Novel Cathodes – Both Energy and Power
- Novel Electrolytes – Liquid, Solid State and Ionic
- Novel Separators – Improved safety, performance and lower cost

**We will focus this am on our  
exclusively licensed MIT  
“High Power Cathode”**

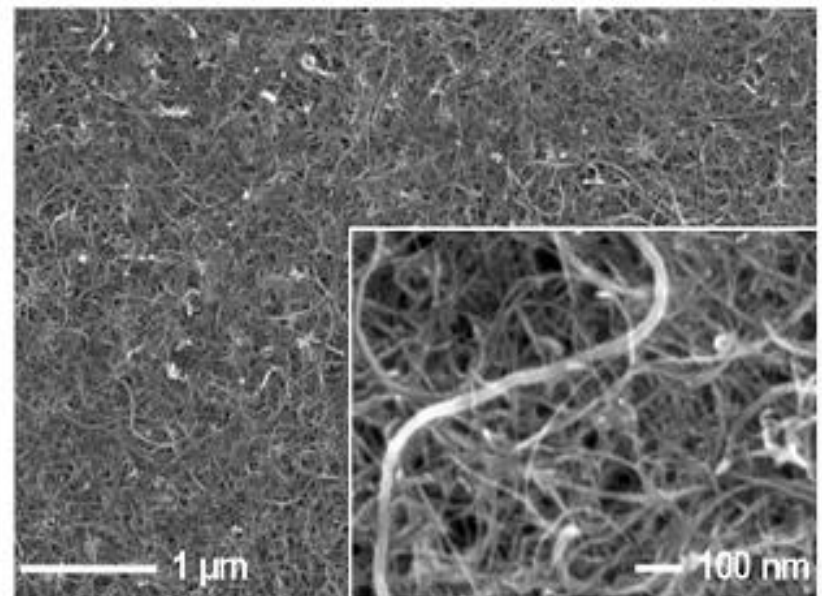
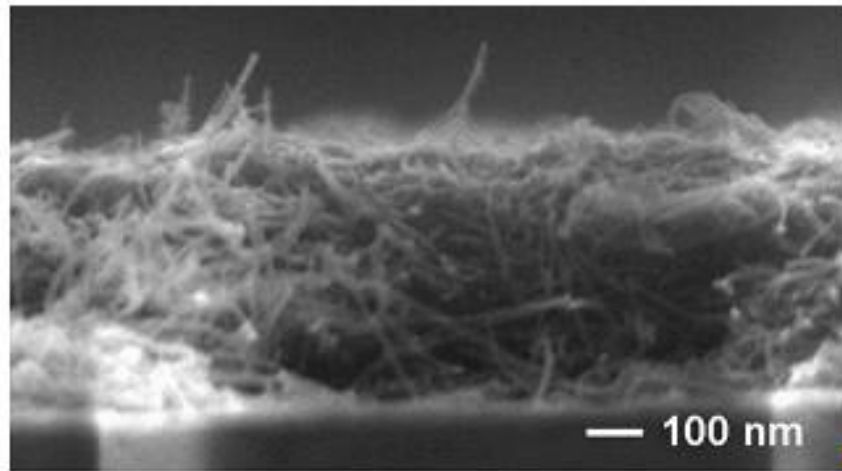


# Layer-by-Layer Nanotechnology for High-Power Rechargeable Batteries

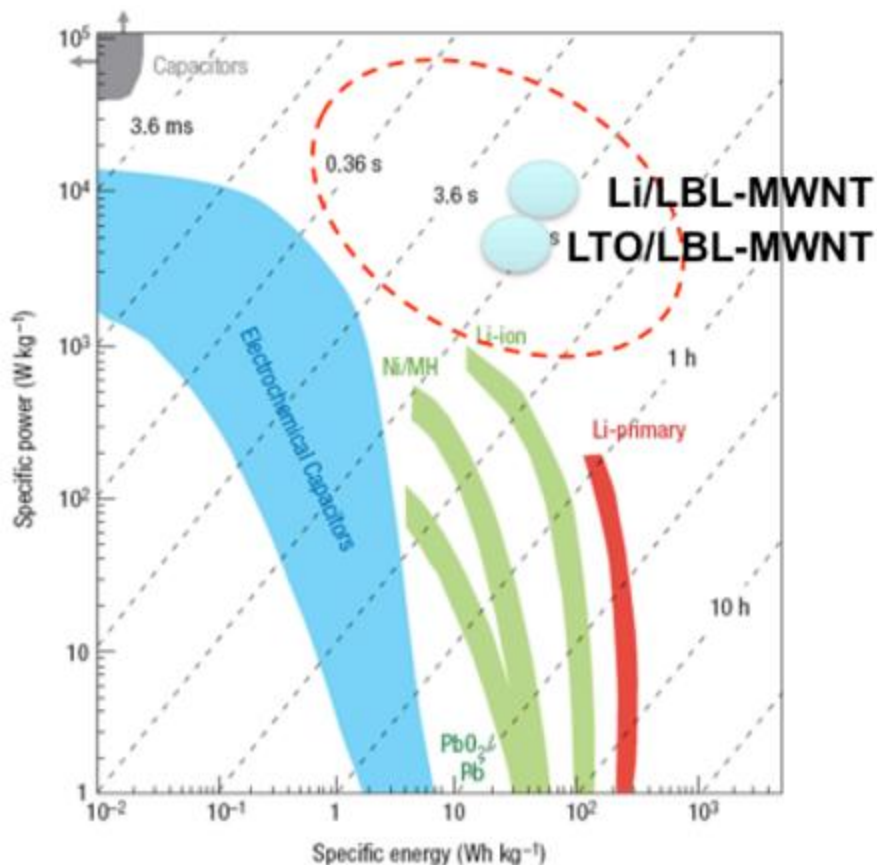


S. W. Lee, B.-S. Kim, S. Chen, Y. Shao-Horn and P. T. Hammond, *J. Am. Chem. Soc.*, **2009**, 131, 671

# Rapid Generation of Dense Nanotube Array



# Advantages Of LbL Hybrid Cells



**Nanotube Electrode Combines High Energy of a Battery with High Power of a Capacitor**

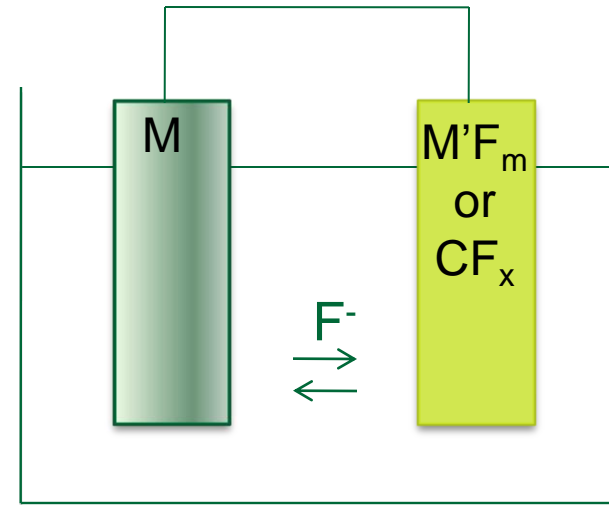
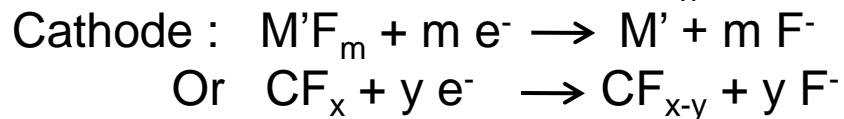
- **Higher Packaged Gravimetric Energy Densities At Higher Gravimetric Power Relative To Li-ion Batteries**
- **Much Higher Gravimetric Energy Densities At Comparable Gravimetric Power To Electrochemical Capacitors**
- **No Binder Or Additives**
  - **All electrode material is active**
- **Excellent Cycle Life**
  - **Stable surface redox reactions**
- **Applicable To Many Substrates**
  - **Flexible, conformal electrodes**
  - **Thin-film cells**
  - **Larger cells under development**
  - **CFx Primary and Advanced Rechargeable**

# Our Next Generation Rechargeable Batteries

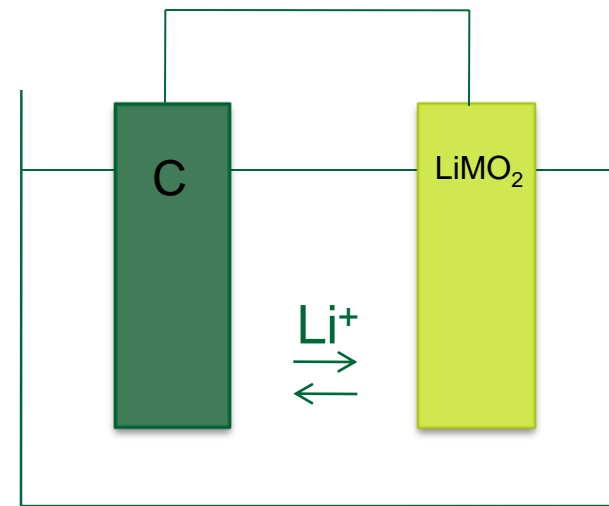
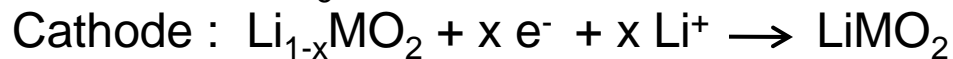
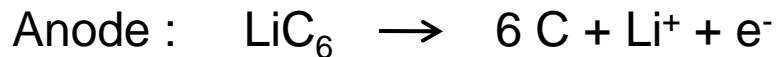
- **Advanced Lithium Ion Batteries**
  - Novel Anodes – Carbon Fiber Composites, Silicon
  - Novel Cathodes – Both Energy and Power
  - Novel Electrolytes – Liquid, Solid State and Ionic
  - Novel Separators – Improved safety, performance and lower cost
- **Next Generation Rechargeable Batteries**
  - Improved Safety – No Lithium
  - Higher Voltage and Broader Temperature Range
  - Superior Performance – Gravimetric and Volumetric

# Contour has identified a new, lithium-free high energy storage device

## FIB Concept:

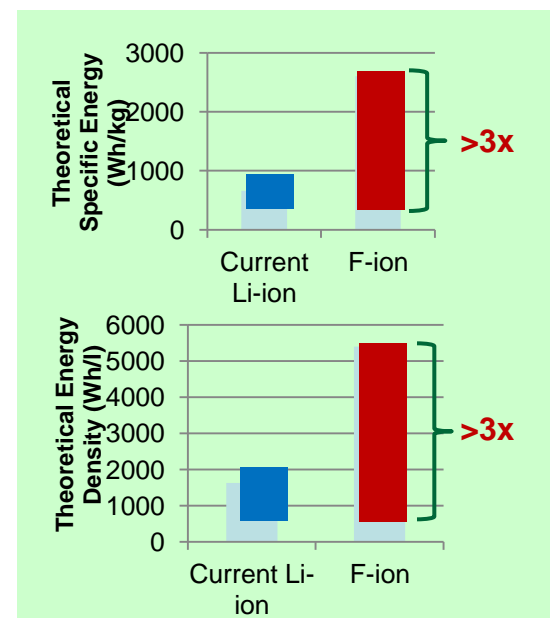


## Related to LIB concept:



# Potential Advantages of Fluoride-Based Redox Systems

- Fluorine is highly electronegative
  - Large  $\Delta G$  between redox states e.g.  $\text{MF}_3/\text{MF}$
- Redox processes can be multi-electron, metal-based
  - Increases energy density of system, monovalent anion migration
- Fluoride is “smallest” anion (130 pm) [ $\sim\text{K}^+$ ]
  - Good mobility, smaller reorganization energy
- Impressive theoretical gravimetric and volumetric capacities
  - Up to 2600 Wh/kg, 5000 Wh/L
- Utilizes abundant, cheap materials
  - No heavy metals



# Why *Contour* Advanced Rechargeables ???

**First, our new MIT Power Cathode will be ready for launch in 2013 featuring....**

- Up to **10X more power** than existing cathodes
  - Ideal for Hybrid Electric Vehicles, PHEV's, Medical Devices and Power Tools

**Then in 2014, we commercialize our “Lithium Free” Fluorion <sup>tm</sup> Rechargeables which have....**

- 3X Theoretical Specific and Gravimetric Energy Densities of Lithium Ion Batteries
- No Lithium
- Higher Voltage



# Conclusion – Why Contour? Why Now?

- A “Hot” sector with huge markets and upside growth
- Game Changing, Disruptive, Next Generation Battery Technologies with Strong IP and Trade secrets
- Strong and Committed Partners
- Experienced and Proven Management Team
- Track record of hitting milestones

***Contour* - RESHAPING the World of Portable Power !!!**

# Thank You..... Questions????

- For more information, contact Joe Fisher at...

[joe.fisher@contourenenergy.com](mailto:joe.fisher@contourenenergy.com) or (626) 610-0660

- Or go to our web at:
- [www.contourenenergy.com](http://www.contourenenergy.com)